

**JONATHAN M. LILLY | Senior Research Scientist, NorthWest Research Associates, lilly@nwra.com**

***Degree: When, where, what, and what in?***

I received a bachelor of science degree from Yale University in 1994 in the atmosphere/ocean track of the Department of Geology & Geophysics. I then went to the University of Washington in Seattle for graduate school, where I received a PhD in physical oceanography in 2002.

***Did you stay in academia at all, and if so, for how long?***

My entire career, after my postdoctoral fellowship, has been soft-money research carried out in a non-university setting, first at a nonprofit and now at a principal investigator-owned company. Because it is a little ambiguous whether or not this qualifies as academia, the answer is either “the whole time” or “not at all.”

***How did you go about searching for a job outside of the university setting?***

While I was a postdoc at the Université Pierre et Marie Curie in Paris, I made plans to return to Seattle. I knew of three organizations in Seattle where one could do soft-money research. I contacted all three of these places, visited, and explained that I was looking for a place where I could establish my own career pathway. I chose to work with the organization that had the most to offer a young scientist, and that could help support me as I established my own funding stream.

***What is your current job? What path did you take to get there?***

I am a senior research scientist at NorthWest Research Associates, based outside of Seattle. After I had been at another institute for about five years, I felt it was time for a change, so I basically picked up the phone. If you have your own funding, finding another employer isn't particularly difficult.

***What did your oceanographic education (or academic career) give you that is useful in your current job?***

I have been fortunate, as a postdoc, graduate student, and undergrad, to have had a number of truly top-notch teachers and mentors. More than just learning conceptual material, being in contact with great thinkers gives you the chance to absorb some aspects of their approaches or worldviews or personalities. These connections have been essential in many ways to my growth as a scientist. It would take a long time to explain in detail.

***Is there any course or other training you would have liked to have had as part of your graduate education to meet the demands of the job market?***

I'm going to rephrase this question and answer instead, “What other trainings, apart from what you learned in graduate school, are necessary to be a successful researcher?”

Formal intellectual studies in graduate school impart only a small fraction of the skills necessary to succeed as a researcher. To be effective, a researcher needs to have a raft of mental and emotional skills that are beyond what we normally think of as being a part of scientific training. In graduate school, there is a tendency to get to the finish line by plowing through with a straightforward combination of intelligence, hard work, and willpower. That's not a viable long-term strategy. There are a lot of factors that contribute to graduate students developing habits that are diametrically opposed to sustainable, creative, and productive research careers.

How to effectively communicate with others, how to be stable in the face of great uncertainty, how to negotiate, how to maintain observational sharpness and detachment even when the results appear to be at their most exciting, how to cultivate curiosity, how to adapt, how to know



when to let go of problems, how to know when to stubbornly persist—these are all essential, if underappreciated, ingredients in the scientific skillset. If you're interested in having the biggest impact in the long term, I think the best thing to do is slow down and get yourself sorted out, in whatever way makes sense to you. There are a lot of resources out there. The earlier in your career, the better. Otherwise, you are going to learn things the hard way and suffer a lot as a consequence.

When you are cooking, you make sure you are working with a sharp knife. If the knife is dull, you sharpen it. You don't hack away with a dull knife because you feel so stressed out about the need to get the meal cooked as soon as possible. But what about in science? Do you feel you have the mental space to take the time to sharpen the knife, if necessary? For me, I find there is a very quiet internal voice that recognizes when something seems to be more difficult than it needs to be. I do my best to listen to that voice, and then go and attend to whatever it is that I need to learn. It isn't always easy to find the space to take a step back in the face of deadlines and other career pressures. However, my experience has been that such an approach leads to becoming more productive as well as more internally peaceful, whereas just plowing through leads

to the opposite.

On a much more practical level, a researcher needs to know how to write proposals. If you think you can just clearly articulate a clever idea that you personally would like to work on and expect to get funded, sorry, that's not how it works. Writing a proposal is much harder and subtler than writing a scientific paper. You have to connect with the needs of the scientific community as well as with the needs of the program. You have to understand the points of view of potential reviewers. You have to say neither too much nor too little. And you have to be able to weather disappointments. It's extremely difficult to learn all of this on your own; you really need to find a successful mentor who can communicate what he or she has learned through long experience.

### ***Is the job satisfying? What aspects of the job do you like best/least?***

To start with, I think it's important to recognize that it's extremely rare to have a job description of trying to understand how the natural world works. It's really a great honor, and that by itself is satisfying.

There are moments in research when you have a breakthrough and suddenly everything make sense. It's as if the whole cosmos rearranges itself, and your previous understanding becomes only one facet of a larger, more complete understanding. For me, this rearrangement has sometimes happened literally in my dreams. Those moments are indeed very satisfying. Yet, it's essential not to get too attached to them, because then you are likely to miss something even more important that is hiding, quietly, in plain sight. Also, most of the time it is not like this, so if you are expecting it to be, then you will not be willing to put in all the necessary hard work, and furthermore, you will lose your objectivity.

When you engage deeply with a research topic, and tenaciously follow it where it leads, you often end up with something you could not possibly have imagined. It's extremely satisfying to help create something that feels whole and

complete, yet also totally unexpected. It's like tracking a mythical animal that nobody believes in and finally finding its lair. It's not so much the satisfaction of having "made" something as it is of having followed your instincts through all kinds of trials and hardships, and discovered something wonderful that you intuited must exist all along.

When you get to have that experience in collaboration with another person, where each of you take turns getting the other through situations that you wouldn't have made it out of on your own, that's even more remarkable. It's not only the satisfaction of having believed in yourself, but also of having been willing to completely trust another person.

When I get up in the morning, there generally isn't anywhere I need to be. There's no one telling me what to do. It's not for everyone, but I really love this kind of freedom. It's like having a gigantic blank canvas, but instead of paint, your media are equations and data. I try to work in a way that is not just true but also beautiful. This freedom of scientific expression is probably my favorite part of my job.

I also love being connected to a larger continuity of thinkers across space and time. Reading the works of great scientists of the past is like listening to Bach or seeing a Shakespeare play: you feel some part of that person's spirit is communicated to you. I have colleagues all over the world, people that I'm connected to because we spend our time thinking about the same things. When I see some of my closest colleagues, we speak in incomplete sentences. It isn't necessary to finish a sentence because so much is shared. An onlooker would have no idea what is going on. Experiences like this really make you feel that you are working on something bigger than yourself, or rather, that there is a larger perspective beyond the personal one with which you are most familiar.

As to aspects of the job that I like least, that's an easy one. It's no secret that it is very difficult to obtain funding these days. Even if you are fortunate enough to get

funding, a project that should take a year could easily take five: two years to get the funding, then say four months per year for three years to work on it. Sometimes you can't get the funding and have to set the whole project aside. When 10 years of your life go by and you still haven't completed a project, simply because the funding didn't arrive at the right time, it starts to seem pretty preposterous.

There is a lot of pressure to educate students and employ postdocs, but there are not enough jobs. It's not just oceanography, it's across the board, as a New York Times article by Gina Kolata, "So Many Research Scientists, So Few Openings as Professors," described recently. Everyone knows this. Just go and look at jobs ads and you'll find post-doctoral offers outnumber faculty offers by 10 to one. It does not really look like a viable career option anymore. Probably my least favorite part of my job is that I can't wholeheartedly recommend it to young people.

### ***Do you have any recommendations for new grads looking for jobs?***

For a new PhD, the most important thing is to figure out what is most important to you personally. After you've figured that out, everything else has to take a back seat. A common dilemma is needing to choose between living where you want to, or having a type of job that you really want. Which is more important? If you are willing to go anywhere in the world, you obviously have more options.

New graduates should know that the social and economic pressures in this field tend to heap stress upon you, giving you too many responsibilities to actually get things done. If you want to have a career and also a life, you have to be highly proactive and make intentional decisions. You have to know when to say no. You can look at all the examples of everyone who has gone before you, all your role models, and take what you want from each of them in order to construct a way of living that makes sense to you. Or, if you don't see any examples of the way you want to live, you can use your imagination. ☺